REMARKS

In order to expedite the prosecution of the present application, the currently pending claims have been amended in order to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Specifically speaking, the limitations of Claims 14-17 have been incorporated into Claims 8 and 9. Accordingly, Claims 14-17 have been canceled. No new matter has been added.

Claims 3, 6 and 8-19 have been rejected under 35 USC 102(b) as being anticipated by Tomita. Claim 7 has been rejected under 35 USC 103(a) as being unpatentable over Tomita and further in combination with Yamada. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

The presently claimed invention is directed to a connecting material for bonding and connecting a semiconductor chip with a substrate glass board and forming a COG assembly in which electrodes provided on the semiconductor chip are held in direct connection with corresponding electrodes provided on the substrate glass board. The connecting material has a tensile elongation percentage at 25°C of at least 5%, after being cured, and comprises an adhesive component comprising 10-94% by weight of an epoxy resin, 0-50% by weight of a thermoplastic polymeric substance and 6-90% by weight of a microparticulate elastomer product selected from the group consisting of natural rubber, isoprene rubber, butadiene rubber, styrene/butadiene rubber, chloroprene rubber and acrylonitrile/butadiene rubber having an average particle size of 30-300 nm and electroconductive particles. The present invention is also directed to a COG which utilizes the above-described connecting material.

The present invention provides a connecting material for bonding and connecting a semiconductor chip with a substrate glass board and a COG assembly. By incorporating a microparticulate elastomer in the connecting material of the present invention, the reduction of stress concentration at

the interface between the connecting material and the glass substrate is achieved, even when a higher adhesion strength of the connecting material is required. This enables the deformation of the glass substrate, such as warping, to be reduced, even when a thin substrate glass board is used, together with providing superior adhesion strength and secured electrical connection.

As discussed previously, the present invention requires a tensile elongation at 25°C of at least 5%, after being cured, in order to achieve the reduction of stress concentration at the interface between the connecting material and the glass substrate. The present inventors have discovered that the tensile elongation percentage of the cured connecting material is improved by the inclusion of a microparticulate elastomer product selected from the group consisting of natural rubber, isoprene rubber, butadiene rubber, styrene/butadiene rubber, chloroprene rubber and acrylonitrile/butadiene rubber having an average particle size of from 30-300 nm. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

EP 0 979 854 (referred to by the Examiner as Tomita) discloses a circuit-connecting material which is interposed between circuit electrodes facing each other, electrically connects the electrodes in the pressing direction and comprises, as essential components, a curing agent capable of generating free radicals upon heating, a hydroxyl group-containing resin having a molecular weight of 10,000 or more and a radical, polymerizable substance. The Examiner states that this reference teaches all of the essential elements of the presently claimed invention. Applicants beg to differ.

As discussed above, it is a critical part of the present invention that the connecting material contain from 6-90% by weight of a microparticulate elastomer product selected from the group consisting of natural rubber, isoprene rubber, butadiene rubber, styrene/butadiene rubber, chloroprene rubber and acrylonitrile/butadiene rubber having an average particle

size of from 30-300 nm. The Tomita reference does not show this. As discussed in paragraphs [0068] through [0072] of Tomita, the connecting material contains an adhesive which is modified through chemical action of an elastomer on a resin having a phenoxy resin skeleton. In contrast to this reference, the connecting material of the present invention contains, as a genuine mixture, a microparticulate elastomer and a resin, in which the microparticulate elastomer has its microparticulate identity preserved even after the curing of the adhesive component without being subjected to any chemical coupling with the resin.

Paragraph [0074] of Tomita discloses the use of an acrylic resin in the rubber as does Example 16 of this reference. However, nothing suggests that the acrylic rubber is present as a microparticulate product. The Tomita reference only discloses an elastomer of a microparticulate structure for an elastomer-modified phenoxy resin. Moreover, there is no suggestion in Tomita with respect to the combination of an epoxy resin with a microparticulate elastomer. As such, this aspect of the present invention clearly is not taught by Tomita.

The Examiner also states in the Office Action that Tomita teaches "a modulus of elasticity of from 100-2,000 MPa, and more preferably, from 1,000-1,800 MPa, at 40°C after curing,". While Applicants do not dispute this statement of the Examiner, the presently claimed invention requires that the connecting material have a tensile elongation percentage at 25°C of at least 5%, after being cured. "Tensile elongation percentage" and "modulus of elasticity" are two different properties and are not necessarily related to each other. Therefore, the Tomita reference does not disclose the claimed tensile elongation percentage and, since the compositions of the connecting materials of Tomita and that of the present invention are different, it is not inherent that both compositions would have the same tensile elongation percentage.

The Yamada reference was cited by the Examiner as disclosing a COG assembly which is a liquid crystal display. However, the Yamada reference does not overcome the deficiencies contained in the primary Tomita reference in that it does not show the presence of microparticulate rubber in a connecting material in an amount of from 60-90 wt.%.

The Satsu et al reference discloses a semiconductor device in which semiconductor elements are connected to metallic bumps on the front side of a substrate and a thermosetting resin composition containing a spherical filler is provided between the semiconductor elements and the substrate. This reference was cited by the Examiner as showing the particular claimed Tg. However, the resin composition disclosed there is different from that of the Tomita reference and different from that of the present invention. As such, the selection of the Satsu et al reference as disclosing a particular Tg and elastic modulus as a secondary reference does not appear to be proper because these properties are inherent to the resin compositions and there is no disclosure in Satsu et al which would teach one of ordinary skill in the art how to modify the primary Tomita reference in a manner that would yield the presently claimed properties or why such a modification would even be advantageous.

Although the Examiner has not made a showing of prima facie obviousness under 35 USC 103, Applicants respectfully submit that objective evidence is of record in the present application which establishes the unexpected advantages associated with the presently claimed invention. In Table 1, on page 21 of the originally filed specification, Examples of the present invention and Comparative Examples are given. Comparative Example 2 is different from the present invention only in the fact that 5 wt.% of a microparticulate rubber is used. Comparative Example 3 uses 10% of an acrylic resin, which corresponds to the acryl rubber of Tomita. As is evident from Table 1, none of the compositions of the

Comparative Examples had a tensile elongation percentage as required by the present claims. Additionally, other physical properties of the comparative compositions were inferior to that of the present invention. Comparative Example 2 is closer to the present invention than the Tomita reference in that it uses only 5 wt.% of a microparticulate rubber as compared to the lower limit of 6 wt.% required in the present claims. The superior properties of the presently claimed invention over the composition of Comparative Example 2 clearly establishes the patentability of the presently claimed invention. As such, the Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,

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